

AMENDMENTS TO THE CLAIMS

Please add new Claim 86 as follows.

1. (Previously presented) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

applying a noble metal on the exposed portion of the metal interconnect;
performing a maskless chemical process that converts a layer of the noble metal into a bondable layer compatible with a wire bonding; and
bonding a metal wire to the bondable layer.

2. (Original) The process of Claim 1, wherein the at least one metal interconnect is substantially copper.

3. (Original) The process of Claim 1, wherein the metal wire comprises aluminum or gold or metal alloy.

4. (Original) The process of Claim 1, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

5. (Original) The process of Claim 1, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

6. (Original) The process of Claim 1, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

7. (Original) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

applying a noble metal on the exposed portion of the metal interconnect;
performing a chemical process that causes a layer of the noble metal to convert into a bondable layer compatible with a wire bonding; and
bonding a metal wire to the bondable layer.

8. (Original) The process of Claim 7, wherein the chemical process causes atoms of the noble metal to be diffused and mixed with metal atoms of the metal interconnect.

9. (Original) The process of Claim 8, wherein the chemical process comprises one of the following: an immersion process, a dip process or an electroless process.

10. (Original) The process of Claim 7, wherein the noble metal substantially comprises Ag, Au, Pd, Pt, Ru, Rh, Re, Os, Ir or any alloy thereof.

11. (Original) The process of Claim 7, wherein the at least one metal interconnect is substantially copper.

12. (Original) The process of Claim 7, wherein the metal wire comprises aluminum or gold or metal alloy.

13. (Original) The process of Claim 7, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

14. (Original) The process of Claim 7, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

15. (Original) The process of Claim 7, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

16. (Original) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

depositing a layer of a noble metal on the exposed portion of the metal interconnect;

converting the layer of the noble metal to a bondable layer compatible with a wire bonding by a chemical process; and

bonding a metal wire to the bondable layer.

17. (Original) The process of Claim 16, wherein the chemical process comprises an immersion process, a dip silver process and an electroless process.

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18. (Original) The process of Claim 16, wherein the at least one metal interconnect is substantially copper.

19. (Original) The process of Claim 16, wherein the metal wire comprises aluminum or gold.

20. (Original) The process of Claim 16, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

21. (Original) The process of Claim 16, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

22. (Original) The process of Claim 16, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

23. (Original) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

forming a layer of a low melting point metal whose melting temperature is relatively low on the exposed portion of the metal interconnect;

converting the layer of the low melting point metal into a bondable layer compatible with a wire bonding by a chemical process; and

bonding a metal wire to the bondable layer.

24. (Original) The process of Claim 23, wherein the chemical process comprises an electroless tin process, a dip tin process and an electroless bismuth process.

25. (Original) The process of Claim 23, wherein the at least one metal interconnect is substantially copper.

26. (Original) The process of Claim 23, wherein the metal wire comprises aluminum or gold.

27. (Previously presented) The process of Claim 23, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

28. (Original) The process of Claim 23, further comprising performing a chemical reaction, a heat treatment or combination thereof on the bondable layer in order to increase the adhesion of the bondable layer on the exposed portion of the metal interconnect.

29. (Original) The process of Claim 23, wherein the melting temperature is below 350°C.

30. (Original) The process of Claim 23, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

31. (Original) The process of Claim 23, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

32. (Original) A process of forming an electrical connection between a metal wire and at least one metal interconnect supported on a semiconductor substrate, the process comprising:

forming the at least one metal interconnect on the semiconductor substrate;

depositing a passivation layer on the metal interconnect, at least a portion of the metal interconnect being exposed to the environment through an opening formed on the passivation layer;

applying a low melting point metal whose melting temperature is relatively low on the exposed portion of the metal interconnect;

converting a layer of the low melting point metal into a bondable layer compatible with a wire bonding on the exposed portion of the metal interconnect; and

bonding a metal wire to the bondable layer.

33. (Original) The process of Claim 32, wherein the at least one metal interconnect is substantially copper.

34. (Original) The process of Claim 32, wherein the metal wire comprises aluminum or gold or metal alloy.

35. (Original) The process of Claim 32, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

36. (Original) The process of Claim 32, further comprising performing a heat treatment on the bondable layer in order to increase the adhesion of the bondable layer on the exposed portion of the metal interconnect.

37. (Original) The process of Claim 32, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

38. (Original) The process of Claim 32, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

39. (Original) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

forming a layer of solder particles of a low melting point metal whose temperature is relatively low on the exposed portion of the metal interconnect;

converting the layer of the solder particles into a bondable layer compatible with a wire bonding; and

bonding a metal wire to the bondable layer.

40. (Original) The process of Claim 39, wherein the at least one metal interconnect is substantially copper.

41. (Original) The process of Claim 39, wherein the metal wire comprises aluminum or gold.

42. (Original) The process of Claim 39, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

43. (Original) The process of Claim 39, further comprising performing a chemical reaction, a heat treatment or combination thereof on the bondable layer in order to increase the adhesion of the bondable layer on the exposed portion of the metal interconnect.

44. (Original) The process of Claim 39, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

45. (Original) The process of Claim 39, wherein the process is additionally applied to any structure formed on the semiconductor substrate on which the wire bonding is carried out.

46. (Original) The process of Claim 39, wherein the forming comprises:
providing a tacky layer on the exposed portion of the metal interconnect; and
applying the solder particles of the low melting point metal on the tacky layer, thus forming the layer of the solder particles.

47. (Previously presented) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

forming a layer of fine particles of a noble metal or an alloy thereof on the exposed portion of the metal interconnect;

converting the layer of the fine particles into a bondable layer compatible with a wire bonding on the exposed portion of the metal interconnect by performing a chemical reaction, a heat treatment or combination thereof on the layer of fine particles; and

bonding a metal wire to the bondable layer.

48. (Original) The process of Claim 47, wherein the at least one metal interconnect is substantially copper.

49. (Original) The process of Claim 47, wherein the metal wire comprises aluminum or gold.

50. (Original) The process of Claim 47, wherein the bonding is performed by an ultrasonic wire bonding, a thermosonic wire bonding, a welding or combination thereof.

51. (Original) The process of Claim 47, wherein the forming comprises:
providing a tacky layer on the exposed portion of the metal interconnect; and
applying the fine particles on the tacky layer, thus forming the layer of the fine particles.

52. (Original) The semiconductor integrated circuit of Claim 47, wherein the semiconductor substrate is selected from the group consisting of: silicon, GaAs, and InP.

53-78. (Cancelled)

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79. (Previously presented) The process of Claim 1, wherein the noble metal is a single metal.

80. (Previously presented) The process of Claim 7, wherein the remaining portion of the metal interconnect is covered by a passivation layer.

81. (Previously presented) The process of Claim 16, wherein the noble metal is a single metal.

82. (Previously presented) The process of Claim 23, wherein the remaining portion of the metal interconnect is covered by a passivation layer.

83. (Previously presented) The process of Claim 32, wherein the low melting point metal is a single metal.

84. (Previously presented) The process of Claim 39, wherein the remaining portion of the metal interconnect is covered by a passivation layer.

85. (Previously presented) The process of Claim 47, wherein the noble metal layer is a single metal layer.

86. (New) A process of forming metal surfaces on a bare metal chip, the metal chip comprising at least one metal interconnect formed on a semiconductor substrate, at least a portion of the metal interconnect being exposed to the environment, the process comprising:

forming a layer of a metal on the exposed portion of the metal interconnect, wherein the metal is selected from one of the following: a noble metal, a low melting point metal whose melting temperature is relatively low, solder particles of a low melting point metal whose melting temperature is relatively low, and fine particles of a noble metal;

converting the layer of the metal to a bondable layer compatible with a wire bonding; and

bonding a metal wire to the bondable layer.